

INC FILE COPY

NON-MEASUREMENT  
SENSITIVE

AD-A206 362

①  
MIL-D-28003  
20 December 1988

**MILITARY SPECIFICATION**

**DIGITAL REPRESENTATION FOR COMMUNICATION OF ILLUSTRATION DATA:  
CGM APPLICATION PROFILE**

This specification is approved for use by all Departments and Agencies of the Department of Defense.

**1. SCOPE**

1.1 **Scope.** This military specification establishes the requirements to be met when 2-dimensional picture description or illustration data that is predominantly vector is delivered in the digital format of the Computer Graphics Metafile (CGM) as specified by its Federal Information Processing Standard, FIPS PUB 128.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be used in improving this document shall be addressed to: Director, CALS Policy Office, DASD(S)CALS Pentagon, Room 2B322, Washington, DC 20301, by using the self addressed Standardization Document approval Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

AREA ILSS

DISTRIBUTION STATEMENT A. Approved for public release:  
distribution is unlimited.

DTIC  
ELECTE  
27 MAR 1989  
S E

1.2 **Classification.** This specification establishes the requirements for the communication or interchange of illustration data in digital format for use in technical illustrations and publications. The CGM Application Profile (AP) defined by this specification consists of three parts: the metafile, the generator, and the interpreter. There shall be only one level for the metafile and generator, and they shall be called conforming basic metafile and conforming basic generator, respectively. The interpreter shall be one of the following two levels as specified by the contract or purchase order:

Level 1 - Publication Level

Level 2 - Draft Level

Publication Level shall be mandatory for final document production. Draft Level defines a level that is suitable for working when documents are in development or draft stage. Additional classes of conforming basic metafiles are expected to be added in future versions of this specification as soon as technical work codifies their requirements and validates fitness for use.

Accession For	
NTIS CRA&I <input checked="" type="checkbox"/>	
DTIC TAB <input type="checkbox"/>	
Unannounced <input type="checkbox"/>	
Justification	
By _____	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

## 2. APPLICABLE DOCUMENTS

### 2.1 Government documents.

2.1.1 Specifications and standards. The following standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplements thereto, cited in the solicitation.

#### STANDARDS

##### FEDERAL

FIPS PUB 128 - Computer Graphics Metafile (CGM)

**Note:** FIPS PUB 128 adopts ANSI X3.122 as a Federal Information Processing Standard Publication (FIPS PUB).

(Copies of the referenced Federal Information Processing Standards are available to Department of Defense activities from the Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120-5099. Others must request copies of FIPS from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.)

#### MILITARY

MIL-STD-1840 - Automated Interchange of Technical Information

(Copies of the referenced military standard are available from the Department of Defense Single Stock Point, Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.)

2.1.2 Other Government documents. The following other Government document forms a part of this document to the extent specified herein. Unless otherwise specified, the issue is that cited in the solicitation.

#### NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

NBS SP 424 - A Contribution to Computer Typesetting Techniques: Tables of Coordinates for

Hershey's Repertory of Oxidental Type Fonts and Graphic Symbols, NBS Special Publication 424, April 1976.

(Application for copies shall be addressed to the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

NATIONAL STANDARDS

ANSI X3.4 - 7-bit American National Standard Code for Information Interchange (7-bit ASCII)

ANSI X3.134/2 - 8-bit American National Standards Code for Information Interchange (8-bit ASCII)

(Application for copies shall be addressed to: American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018).

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

3.1 General requirements. This specification defines conformance of a CGM metafile in terms of "permissible" and "basic" values. Permissible values are the range of values of CGM elements as specified in FIPS PUB 128. Basic values are a subset of the permissible values, in some cases augmented by additional values contained in this specification, and they constitute the "Basic Set." For example, permissible values of MARKER TYPE include all non-zero integers, while basic values are limited to the specific values 1 to 5. A conforming basic metafile shall contain no elements or parameters outside of the Basic Set. The CGM AP which corresponds to the illustration data to be communicated shall be in the form of one or more conforming basic metafiles.

3.1.1 Conforming basic generator. A conforming basic generator shall be defined to be one that produces only conforming basic metafiles (or can be reliably commanded to function in that mode), and additionally conforms to any additional generator requirements as explained in the subsections below.

3.1.2 Conforming basic interpreter. A conforming basic interpreter shall be defined to be one that at least correctly interprets any conforming basic metafile, and conforms to any additional interpreter requirements as explained in the subsections below. In addition, any conforming basic interpreter shall be able to parse and skip any elements that it does not understand or support, and any parameter values that it does not support. For interpreters, there shall be two levels of conformance for judging what comprises "correct" interpretation of a metafile:

Level 1 - Publication Level: All of the specifications of FIPS PUB 128 and of this CGM AP shall be accurately implemented. This includes the guidelines of FIPS PUB 128 annex D.2 and D.5, and the recommendations for the treatment of indeterminate specifications of circular and elliptical primitives in FIPS PUB 128 annex D.4.5. The results shall be completely predictable across implementations conforming at this level; that is, suitable for publication as the name implies.

At Publication Level, interpreters shall render all text at "stroke" precision, regardless of the value of the metafile TEXT PRECISION element.

Level 2 - Draft Level: The guidelines of FIPS PUB 128 annex D.2 (degeneracies) and D.3 (mapping color to black-and-white) shall be implemented.

In the case that the output device has only two colors available (foreground and background) metafile colors shall be mapped to device colors as follows. If the metafile color selection mode is "direct" the value of the metafile BACKGROUND COLOUR shall map to one of the device colors (the background color); any color value of any other metafile element which is exactly equal to the value of the metafile BACKGROUND COLOUR shall also map to the device background color; all other color values in the metafile shall map to the other device color (the foreground color). If the metafile color selection mode is "indexed", only the BACKGROUND COLOUR and COLOUR TABLE elements contain RGB values to be mapped. The metafile "effective background color" is defined to be the value of the BACKGROUND COLOUR element, or the value of the COLOUR TABLE setting of index 0 if the BACKGROUND COLOUR has been thus superseded. Then the effective background color shall map to one of the device colors (the background color); any COLOUR TABLE values which exactly match the effective background color shall also map to this value; all other RGB values shall map to the other device color (the foreground color).

The recommendations for the treatment of indeterminate specifications of circular and elliptical primitives in D.4.5 shall be followed. The capabilities of annex D.5 of FIPS PUB 128 and of the Basic set as defined in this specification shall be present; however, the following interpreter fallback actions of D.4 may be taken:

AUXILIARY COLOR	CHARACTER SPACING
APPEND TEXT	CHARACTER HEIGHT
RESTRICTED TEXT	CHARACTER ORIENTATION
CELL ARRAY	CHARACTER SET INDEX
LINE WIDTH	MARKER SIZE
EDGE WIDTH	TEXT PRECISION
PATTERN SIZE	CHARACTER EXPANSION FACTOR

For LINE TYPE and HATCH INDEX, the interpreter shall have the capabilities of D.5 of FIPS PUB 128. However, the interpreter may take fallback actions for the additional line types of Table IV and hatch styles of Table V below.

Draft Level conformance for interpreters shall allow black and white to be reversed in the first two indexes of the implicit default color table specified in 3.2.8.2. Draft level conformance for interpreters shall allow interpreters to ignore the line type and edge type continuation specifications of 3.2.4.3 and 3.2.4.4.

3.1.3 Limits on parameter data. A conforming basic metafile shall not contain scalar values of parameter data outside the ranges specified by this specification.

3.1.4 Encoding format. A conforming basic metafile shall use only the CGM Binary Encoding, as defined in FIPS PUB 128, part 3. [NOTE: Future CGM application profiles may be developed (or this profile extended) for the character (FIPS PUB 128, part 2) or clear text (FIPS PUB 128, part 4) encodings of CGM.]

3.1.5 Physical file structure. All basic metafiles conforming to this specification shall consist of 80-octet records. When files are being transmitted on magnetic tape, the 80-octet logical records shall be blocked into 800-octet physical records.

3.1.6 Errors in FIPS PUB 128. A number of editorial errors have been found to exist in the published version of ANSI X3.122. In order to prevent errors in the use of FIPS PUB 128 within this specification, the following changes to ANSI X3.122 shall apply:

Part 1, p. 100, the last item on the page: "1" should be "0" and "foreground" should be "background".

Part 3, p.17, item 11: the fraction numerator which is "pxn" should be "pxn-1".

Part 3, p.26, VDC REAL PRECISION: "3I" should be "E,2I".

Part 1, clause 5.2.1 (p. 43), clause 5.3.12 (p. 49), and clause 6 (p. 100): To make clear and remove contradictory statements in these clauses--Metafile Descriptor elements shall not return to default at BEGIN PICTURE, and they shall not be included in the METAFILE DEFAULTS REPLACEMENT.

Part 1, p.106, the expansion of "<metafile contents>": the "|" symbols should be deleted.

3.2 Specific requirements. The following subsections define the specific requirements for conforming metafiles, generators, and interpreters. An application profile shall use the specified element types of FIPS PUB 128 with the constraints as specified below.

3.2.1 Metafile constraints. The Basic Set shall be defined by the limitations on Basic Values noted below. Where an element is not mentioned, it is implied that the Basic Set shall include all values permitted in FIPS PUB 128.

3.2.1.1 Delimiter elements. The only constraint on delimiter elements shall be for no-op, and the basic values allowed shall be an arbitrary sequence of  $n$  octets,  $n=0..32767$ .

3.2.1.2 Metafile descriptor elements. The metafile descriptor element constraints shall be as specified in table I.

TABLE I. Metafile descriptor element constraints

Element	Basic Values
METAFILE DESCRIPTION	(Note 1)
INTEGER PRECISION	16
REAL PRECISION	(1,16,16) (fixed point) (0,9,23) (floating point)
INDEX PRECISION	16
COLOUR PRECISION	8, 16
COLOUR INDEX PRECISION	8, 16
FONT LIST	(Note 2)
CHARACTER SET LIST	(0,4/2) (Note 3) (1,4/1) (Note 4)
CHARACTER CODING ANNOUNCER	0 (Basic 7-bit) 1 (Basic 8-bit)

Note 1: The METAFILE DESCRIPTION element's string: a) shall include a substring briefly identifying company or product, so that interpreters can account for known idiosyncrasies of generators; b) shall contain the substring "MIL-D-28003/BASIC-1".

Note 2: Four simultaneous fonts are supported. The font names are selected from the basic font names in 3.2.5.

Note 3: The character set is ANSI X3.4, 7-bit American National Standard Code for Information Interchange (7-bit ASCII).

Note 4: The character set is ANSI X3.134/2, 8-bit American National Standards Code for Information Interchange (8-bit ASCII). [Note: This is equivalent to ISO 8859/1, Right-Hand Part of Latin Alphabet Number 1.]

3.2.1.3 Picture descriptor elements. Note that the scale-factor parameter of SCALING MODE is always a floating point number, even when REAL PRECISION has selected fixed point for other real numbers. It is not apparent in FIPS PUB 128 what the precision of this floating point parameter is when fixed point reals have been selected: its precision shall be (0,9,23).

3.2.1.4 Control elements. Control element constraints shall be as specified in table II.

TABLE II. Control element constraints

Element	Basic Values
VDC INTEGER PRECISION	16, 32
VDC REAL PRECISION	(1,16,16) (fixed) (0,9,23) (floating point)
TRANSPARENCY	1 (on)

**Note:** VDC stands for Virtual Device Coordinates,  
the coordinate system of FIPS PUB 128.

3.2.1.5 Graphical primitives. To ensure portability and predictability of results, conforming basic metafiles shall not contain any Generalized Drawing Primitive (GDP) elements. [Note: Future addenda to this specification may specify GDP elements to be included in the Basic set.]

3.2.1.6 Attribute elements. Attribute element constraints shall be as specified in table III.

TABLE III. Attribute element constraints

Element	Basic Values
LINE BUNDLE INDEX	1-5
LINE TYPE	1-5 (Note 1)
MARKER BUNDLE INDEX	1-5
MARKER TYPE	1-5
TEXT BUNDLE INDEX	1-2
TEXT FONT INDEX	1-4 (Note 2)
CHARACTER SET INDEX	1-2 (Note 2)
ALTERNATE CHARACTER SET INDEX	1-2 (Note 2)
FILL BUNDLE INDEX	1-5
HATCH INDEX	1-6 (Note 3)
EDGE BUNDLE INDEX	1-5
EDGE TYPE	1-5
PATTERN TABLE	Starting Index, 1-8 nx, 1-16 ny, 1-16 start index 0-255
COLOUR TABLE	

Note 1: Additionally, the line types defined in 3.2.2.1 shall be included in the Basic Set of this specification.

Note 2: The character set selected shall be representable in the font selected.

Note 3: Additionally, the hatch styles (indexes) defined in 3.2.2.2 shall be included in the Basic Set of this specification.

For indexed color selection, either all color indexes used in the metafile shall have their representations defined by use of the COLOUR TABLE element, or none shall. A color index is "used" if it occurs in an element selecting a color value to be applied to a primitive (LINE COLOR, CELL ARRAY, etc). A color index is also "used" if it is the default for a primitive attribute and the default applies to a displayed primitive.

3.2.1.7 ESCAPE element. To ensure portability and predictability of results, CGM application profiles conforming to this specification may contain only those ESCAPE elements that are defined in 3.2.6.

3.2.1.8 External elements. The "action required" flag of the MESSAGE element shall be restricted to the value "no action required."

### 3.2.2 Additional attribute values

3.2.2.1 Line types. The additional line types specified in table IV shall apply (see figures 1 through 10 for examples).

TABLE IV. Additional line types

LINE TYPE	CGM parameter value
chain line	-11301
center line	-11302
hidden line	-11303
phantom line	-11304
double arrow	-11305
single dot	-11306
single arrow	-11307
stitch line	-11308
break line, style 1	-11309
break line, style 2	-11310

3.2.2.2 Hatch styles. The additional hatch styles specified in table V shall apply (see figure 11 for examples).

TABLE V. Additional hatch styles

HATCH STYLE	CGM parameter value
across grain wood	-11401
with grain wood	-11402
bronze, brass, copper, and compositions	-11403
cast iron or malleable iron and general use for all materials	-11404
steel	-11405
concrete	-11406
cork, felt, fabric, leather, and fiber	-11407
magnesium, aluminum, and aluminum alloys	-11409
marble, slate, glass, porcelain, etc.	-11410
rock	-11411
rubber, plastic, and electrical insulation	-11412
sand	-11413
sound insulation	-11414
thermal insulation	-11415
titanium and refractory material	-11416
water and other liquids	-11417
white metal, zinc, lead, babbitt, and alloys	-11418

3.2.3 FIPS PUB 128 defaults. The defaults of all elements in this Application Profile shall be as specified in clause 6 of Part 1 of FIPS PUB 128. Conforming basic metafiles are permitted to contain one or more METAFILE DEFAULTS REPLACEMENT elements to redefine any of these values.

3.2.4 Specification of semantic ambiguities. FIPS PUB 128 leaves the semantics of a number of graphical details unspecified or "implementation dependent." This is unacceptable where predictable interchange is required. The following specifications shall apply for conforming basic generators and interpreters of this specification:

3.2.4.1 View surface clearing. Unless clearing is suppressed by 'ESCAPE -301' (see 3.2.6.1), the view surface shall be cleared upon interpretation of the BEGIN PICTURE BODY element.

3.2.4.2 Clipping. When the CLIP INDICATOR is "off", clipping shall be done to the intersection of the device viewport and the device view surface limits. When clipping is "on", clipping shall be done to the intersection of the clip rectangle, the VDC EXTENT, the device viewport and the device view surface limits.

3.2.4.3 Line type continuation. Line type shall be maintained (continued) across the interior vertices of a polyline.

3.2.4.4 Edge type continuation. Edge type shall be maintained (continued) across the vertices of a filled area boundary.

3.2.5 Font specifications. The fonts in table VI are public domain fonts, available as part of NBS SP 424. All of these fonts shall be considered basic capabilities of a basic metafile conforming to this specification. Any of these fonts may appear in the FONT LIST element in a basic metafile that conforms to this specification. Font name shall be the concatenation of the string "HERSHEY:", to designate one of the Hershey fonts, and a "name string" to designate the particular typeface.

TABLE VI. Basic font names

1.	HERSHEY:CARTOGRAPHIC_ROMAN
2.	HERSHEY:CARTOGRAPHIC_GREEK
3.	HERSHEY:SIMPLEX_ROMAN
4.	HERSHEY:SIMPLEX_GREEK
5.	HERSHEY:SIMPLEX_SCRIPT
6.	HERSHEY:COMPLEX_ROMAN
7.	HERSHEY:COMPLEX_GREEK
8.	HERSHEY:COMPLEX_SCRIPT
9.	HERSHEY:COMPLEX_ITALIC
10.	HERSHEY:COMPLEX_CYRILLIC
11.	HERSHEY:DUPLEX_ROMAN
12.	HERSHEY:TRIPLEX_ROMAN
13.	HERSHEY:TRIPLEX_ITALIC
14.	HERSHEY:GOTHIC_GERMAN
15.	HERSHEY:GOTHIC_ENGLISH
16.	HERSHEY:GOTHIC_ITALIA

3.2.6 Escape elements. Support of the following ESCAPE elements shall be required in conforming implementations under this specification.

3.2.6.1 Disable clearing of view surface. The normal interpretation of a CGM metafile is such that the view surface of a device is cleared on each BEGIN PICTURE BODY element. This ESCAPE element will disable the clearing of the view surface for all of the pictures in the metafile. The effect of this ESCAPE element is to permit multiple metafile pictures to be imaged on the same view surface with a mapping as described in FIPS PUB 128. The pictures may have different VDC Extents. Thus, each picture shall be mapped into the current device viewport (whether

default or specified by the Device Viewport ESCAPE element). If used, this ESCAPE element must appear in the Metafile Descriptor. This ESCAPE element shall be a basic capability of the CGM Application Profile under this specification.

Escape Identifier: -301

Escape Data Record: null

3.2.6.2 Device viewport. The default device viewport is the largest rectangular area of the view surface. The viewport is redefined by this ESCAPE element by specifying two corner points. The effective viewport shall be the largest rectangle in the viewport having the same aspect ratio as the VDC EXTENT, and having the same lower-left corner as the device viewport. The VDC EXTENT shall be mapped onto the effective viewport when the picture is interpreted. The units with which the two points are specified shall be real fractions [0.0 to 1.0], which shall be applied to the device viewport. If used, this ESCAPE element must appear in the Picture Descriptor. If the SCALING MODE has been set to metric, then the device viewport shall have precedence -- the SCALING MODE shall be treated as if it were abstract.

Escape Identifier: -302

Escape Data Record: A single string of text containing the specification of the viewport. Parameters in the viewport shall be separated by at least one blank character and/or a single comma character. The decimal point of the real fraction shall be required. Leading zeroes of the real fraction shall be optional. There are four parameters:

P1: First corner x-coordinate. Real fraction of the default device viewport, in the range [0.0,1.0].

P2: First corner y-coordinate. Real fraction of the default device viewport, in the range [0.0,1.0].

P3: Second corner x-coordinate. Real fraction of the default device viewport, in the range [0.0,1.0].

P4: Second corner y-coordinate. Real fraction of the default device viewport, in the range [0.0,1.0].

Example: a viewport equal to the upper right quarter of the default viewport could be coded as:

Escape Identifier	-302
Escape Data Record	".5 .5 1. 1."

This ESCAPE element shall be a basic capability of the CGM Application Profile of this specification.

3.2.6.3 Implicit Color Table. The default COLOUR TABLE is undefined in FIPS PUB 128. It is always possible to specify an entire default COLOUR TABLE with METAFILE DEFAULTS REPLACEMENT. This ESCAPE element provides: a shorthand method to specify a default color table from a small set of predefined tables; and a method to specify that the interpreter shall define its own color table according to available resources. This ESCAPE shall be allowed in the Metafile Descriptor. The single integer parameter of the ESCAPE shall have the following meanings:

- 0: "none" -- There is no implicit default value of the COLOUR TABLE. Interpreters shall associate representations with color indexes as they see fit, or as specified by COLOUR TABLE elements.
- 1: "cyclic" -- the interpreter shall initialize its COLOUR TABLE to contain
  - 0 - white
  - 1 - black
  - 2 - red
  - 3 - green
  - 4 - blue
  - 5 - yellow
  - 6 - magenta
  - 7 - cyan
  - 8 - black
  - 9 - white
  - 10 through 255 - cyclic repetition of 2-9.
- 2: "uniform" -- The interpreter shall initialize its COLOUR TABLE to: black in index 0; and beginning at index 1, 224 representations that shall uniformly sample the RGB color cube as follows:

- 5 levels of red evenly spaced from maximum to none;
- 9 levels of green evenly spaced from maximum to none;
- 5 levels of blue evenly spaced from maximum to none.

The color cube shall be mapped to the linear array by varying the red dimension most rapidly, then the green dimension, then the blue dimension. Note that the 225th element implied by this sequence, black, shall not be put into the table. Beginning at index 225 shall be 31 levels of gray. Index 225 shall be 1/32 (very dark). Succeeding entries shall be 1/32 lighter. The last value is 31/32 (very light), at index 255. [Note: The values of 8/32, 16/32, and 24/32 are redundant in that they are already contained in the color cube section of this definition.]

The default value shall be 1, "cyclic."

**Escape Identifier:** -303

**Escape Data Record:** A single string of text containing the single integer parameter of this ESCAPE element. The integer is encoded as "clear text", i.e., value 2 is encoded as the string comprised of (or containing) the ASCII character "2".

This ESCAPE element shall be a basic capability of the CGM Application Profile of this specification.

**3.2.7 Implementation dependencies.** This section specifies implementation dependencies and environmental constraints for CGM APs conforming to this specification.

**3.2.7.1 General guidelines for FIPS PUB 128 elements.** Unless otherwise noted in this specification, the guidelines of FIPS PUB 128 Annex D shall apply to conforming basic generators and interpreters as defined in 3.1.

**Name:** METAFILE DEFAULTS REPLACEMENT

**Description:** The METAFILE DEFAULTS REPLACEMENT element shall not be partitioned. Note that FIPS PUB 128 permits multiple occurrences of this element, so that partitioning is not required. Partitioning shall be permitted for all other elements.

Name: RESTRICTED TEXT

Description: A conforming basic interpreter shall render the complete RESTRICTED TEXT string (including appended text), scaled isotropically (i.e., specified aspect ratio for the text is not distorted) such that the string fits into the text extent parallelogram.

Name: COLOUR TABLE

Description: The COLOUR TABLE element has an unspecified effect when it appears in a picture subsequent to any graphical primitives. If a COLOUR TABLE element defining the representation of a given color index appears in a picture, it shall appear before reference to that index by an attribute element or use of that index by a graphical primitive element (included in the latter shall be implicit use of default color index attribute values by the first occurrence of an associated primitive). Once a given color representation is defined and used, it shall not be redefined. [Note: These restrictions insure that interpreting systems without dynamic color update capabilities shall be able to render the intended picture accurately.]

Name: PATTERN TABLE

Description: The PATTERN TABLE element has an unspecified effect when it appears in a picture subsequent to any graphical primitives filled with the affected pattern index. If a PATTERN TABLE element defining the representation of a given pattern index appears in a picture: a) it shall appear before explicit reference to that index by any PATTERN INDEX element; or b) in the case of the default PATTERN INDEX, it shall appear before any implicit reference caused by the first occurrence of an associated filled primitive. Once a given pattern representation is defined and used, it shall not be redefined. [Note: These restrictions

insure that interpreting systems without dynamic pattern update capabilities shall be able to render the intended picture accurately.]

3.2.8 Implementation requirements for conforming basic generators and interpreters. The specifications in this section shall augment those of FIPS PUB 128, Part 1, annex D.5, and Part 3, clause 8.

3.2.8.1 Additional generator specifications. Conforming basic generators shall provide to applications the means to either select the implicit COLOUR TABLE for a metafile (e.g., via a mechanism to cause generation of 'ESCAPE -303') or to ascertain the value that will be used in the metafile. The means to ascertain the value shall consist of either a software inquiry mechanism or documentation accompanying the system. An inquiry mechanism shall be the preferred method.

3.2.8.2 Additional interpreter specifications. In the absence of any COLOUR TABLE elements, or of ESCAPE -303 (see 3.2.6.3), in the metafile, conforming basic interpreters shall initialize their color tables as follows: index 0 shall be set to white; index 1 shall be set to black; and indexes 2-254 shall be set by cyclic repetition of the 8 entries specified in table VII.

TABLE VII. Default COLOUR TABLE

Index	Values	Meaning
2	(1.0,0,0)	Red
3	(0,1.0,0)	Green
4	(0,0,1.0)	Blue
5	(1.0,1.0,0)	Yellow
6	(1.0,0,1.0)	Magenta
7	(0,1.0,1.0)	Cyan
8	(0,0,0)	Black
9	(1.0,1.0,1.0)	White

Note: The values '1.0' in the preceding table denote full intensity for the appropriate component.

3.2.8.3 Minimum data structure support. The following named elements shall have basic values as defined below:

Name: Maximum Color Array Dimension

Description: The basic value for the number of color values that can appear in a color array or color list parameter shall be: 1048576 for CELL ARRAY (one 1024x1024 image); 2048 for PATTERN TABLE (eight 16x16 patterns); 256 for COLOUR TABLE (entries 0-255). CELL ARRAY and PATTERN TABLE have color array parameters and COLOUR TABLE has a color list parameter.

Name: Maximum Point Array Length

Description: The basic value for the number of points and VDC that can appear in parameters for metafile elements shall be 1024.

Name: Maximum String Length

Description: The basic value for the length of an individual string of characters shall be: 254 for all string parameters except data records; 32767 for data records.

Name: Bundle Table

Description: Bundle representations are not settable in the current version of FIPS PUB 128. To insure predictable results, interpreters and generators conforming to the CGM Application Profile of this specification shall use the default values from table VIII.

TABLE VIII. Default bundle tables

Bundle Index					
Bundle Type	1	2	3	4	5
<u>Line Bundle</u>					
LINE TYPE	solid	dash	dot	dash-dot	dash-dot-dot
LINE WIDTH	1	1	1	1	1
LINE COLOUR	1	1	1	1	1
<u>Marker Bundle</u>					
MARKER TYPE	dot	plus	asterisk	circle	cross
MARKER SIZE	1	1	1	1	1
MARKER COLOUR	1	1	1	1	1
<u>Text Bundle</u>					
FONT INDEX	1	1			
TEXT PRECISION	stroke	stroke			
CHARACTER EXPANSION					
FACTOR	1	0.7			
CHARACTER					
SPACING	0	0			
TEXT COLOUR	1	1			
<u>Fill Bundle</u>					
INTERIOR STYLE	hatch	hatch	hatch	hatch	hatch
FILL COLOUR	1	1	1	1	1
HATCH INDEX	1	2	3	4	5
PATTERN INDEX	1	1	1	1	1
<u>Edge Bundle</u>					
EDGE TYPE	solid	dash	dot	dash-dot	dash-dot-dot
EDGE WIDTH	1	1	1	1	1
EDGE COLOUR	1	1	1	1	1

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure that supplies and services conform to prescribed requirements.

4.2 Responsibility for compliance. All items shall meet all requirements of section 3. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.3 Inspection procedures. All entities, attributes and parameter values shall be analyzed for conformance to FIPS PUB 128 and to section 3 of this specification for a conforming basic metafile. This shall be accomplished with an appropriate software utility, or conformance test suite. All conforming basic metafiles contained in a particular CGM application profile shall be displayed and checked visually for conformance to the requirements of FIPS PUB 128 and of section 3 in its entirety.

4.3.1 Font rendering. Until publication of ISO 9541, Font and Character Information Interchange, this specification shall consider any rendering of a requested font conforming if the rendering is "metrically identical" to the font metrics of the requested font. This means that the placement and alignment of the string and the placement, size, and shape of individual characters (i.e., the drawn portions of the character cells) shall be measurably identical. This does allow a good quality filled font to be substituted for a stroked Hershey font, for example. Finally, the Hershey "fonts" are really a mixture of fonts and character sets (e.g., Greek is a character set). The requirements of this specification shall be served by providing that the necessary character sets be supported in part, and the

necessary typefaces be supported in part, so that the combinations required to render the listed 16 Hershey "fonts" shall be supported in full. It is recognized that the Hershey fonts may not be of adequate quality for modern publication requirements.

4.3.2 Error processing. A conforming basic interpreter shall recover from any exception condition. If there is something which is not understood by the interpreter, then if possible that element should be skipped, appropriate error warnings generated or logged, and interpretation continue with the next element following the problem element.

## 5. PACKAGING

Packaging of illustration data files for delivery shall be in accordance with the requirements of MIL-STD-1840.

## 6. NOTES

6.1 Intended use. This specification is designed to be incorporated into a contract to define the technical requirements to be met when it is desired to purchase illustration or picture description data (in contrast to product definition data) in digital form for use in technical illustrations and technical publications. A CGM AP under this specification represents illustration data in the form of a conforming basic metafile, i.e., it contains, in device-, system-, and implementation-independent form, the picture description data represented by the functions invoked through an application program interface. A CGM AP contains the allowable output primitives and attributes which may be used to compose the picture. In addition, the CGM AP of this specification specifies certain constraints on CGM generators and interpreters to remove implementation dependencies, thereby serving to ensure predictable interchange of conforming basic metafiles between clients.

6.1.1 Explanation of CGM AP. The syntactic specification in the FIPS PUB 128 is complete and unambiguous. It is, as well, redundant in the sense that there are three distinct encodings of the same functionality: binary, character, and clear text. The redundancy serves a useful purpose, as each encoding is tailored to certain computing environments and applications, and so the CGM client has the opportunity to choose a syntax that is optimized to the intended application. The binary encoding has been chosen as the only encoding which will be supported by this military specification at this time.

The semantic specification is less complete. The expected overall results of using the geometric primitive elements are well enough specified. However some of the finer details, such as the precise appearance of joints and endpoints in lines, are unspecified. This underspecification of semantics was intentional on the part of the standards committees formulating the CGM standard, since it allows a wider range of existing systems to be accommodated and makes the standard more adaptable to the various needs and philosophies of a diverse clientele.

On the other hand, the semantic ambiguity does mean that there will be no single correct interpretation of a given CGM metafile, and hence it will be difficult to unambiguously describe an

intended picture using the CGM standard. This is a distinct drawback in certain application environments, such as the areas of Technical Illustration and Technical Publishing.

There are further sources of uncertainty in using CGM in an application environment. A CGM metafile is produced by a component of a graphics environment known as a "metafile generator." The content of a CGM metafile is rendered into pictures by a component known as a "metafile interpreter." FIPS PUB 128 specifically excludes standardization of the behavior of metafile generators and metafile interpreters. (Most such behavior is described as "implementation dependent.") In doing so, a certain unpredictability of results is introduced into the graphics system viewed as a whole; for example, CGM generators serving GKS (Graphical Kernel System, ANSI X3.124) clients in the product lines of two different vendors might map out-of-range attributes differently.

These two sources of ambiguity in using the CGM standard--incomplete semantics and non-specification of the behavior of generators and interpreters--do not diminish the utility of FIPS PUB 128 for technical illustration and technical publishing. It is a sound and suitable basic protocol for these areas. But they do mean that some further specification (beyond that in the published standard) is required in order for the use of the CGM standard to be effective and unambiguous.

Such a specification is precisely what an Application Profile (AP) consists of. In the case of CGM, an AP specifies:

1. complete semantics;
2. the behavior of CGM generators and CGM interpreters;

An AP specifies minimal and maximal requirements for generators and interpreters, and ties down all implementation dependencies of the CGM metafile. As the name suggests, the AP for CGM is a set of specifications appropriate to a given application environment.

**6.1.2 Metafile Descriptor Elements.** It is unclear in FIPS PUB 128 whether there should be a mandatory ordering of Metafile Descriptor elements (the grammar implies some). Addendum 1 of FIPS PUB 128 will impose such an ordering when it becomes part of the standard; **METAFILE VERSION**, **METAFILE ELEMENT LIST**, and **METAFILE DESCRIPTION** are the first three elements, in that order. This is to point out that such an ordering may become mandatory in a future revision of this specification.

6.1.3 Additional attribute values.

6.1.3.1 Line types. The line types specified in table IV of 3.2.2.1 have been submitted to ANSI and ISO, the International Standards Organization, for graphics registration (see figures 1 through 10 for examples). The figures for these line types are taken from the latest draft of the registration proposals that have been submitted to ANSI and ISO. In table IV, the name of the line type is given, followed by the numeric value (the line type parameter) by which it is to be referenced. These references may change in future amendments to this specification.

6.1.3.2 Hatch styles. The hatch styles in table V of 3.2.2.2 have also been submitted for graphical registration (see figure 11 for examples). The hatch style examples of figure 11 are taken from ANSI Y14.26M, Engineering Drawing and Related Documentation Practices--Digital Representation for Communication of Product Definition Data. In table V, the name of the hatch style is given, followed by the numeric value (the hatch index parameter) by which it is to be referenced. This reference may change in future amendments to this specification.

6.1.4 Fonts and Character Sets. This Application Profile contains two character sets in the BASIC Set, ASCII and ANSI X3.134/2 ("Right Hand Part of Latin Alphabet Number 1"). The Basic Set also specifies the Hershey fonts as the only basic font capability. There is finally the requirement that the requested character set be representable in the requested font. X3.134/2 is not fully representable in the Hershey fonts. Therefore, in this specification it is effectively unusable in conforming basic metafiles. This situation will be remedied when the font set of this specification is extended. It is intended and anticipated that this will be done in a future revision of this specification.

6.2 Ordering data. The contract or purchase order should specify the following:

- a. Title, number, and date of this specification.
- b. The application profile should specify whether it is meant for publication level or draft level interpretation. (See 3.1.2)

6.3 Definitions.

6.3.1 Acronyms and abbreviations used in this specification. Acronyms and abbreviations used in this specification are defined as follows:

- a. ANSI - The American National Standards Institute.
- b. AP - Application Profile.
- c. CGM - Computer Graphics Metafile. Synonymous with FIPS PUB 128.
- d. FIPS - Federal Information Processing Standards.
- e. GDP - Generalized Drawing Primitive.
- f. GKS - Graphical Kernel System.
- g. ISO - International Standards Organization.
- h. PUB - Publication.
- i. SP - Special Publication.
- j. VDC - Virtual Device Coordinates, the coordinate system of FIPS PUB 128.

6.3.2 Application Profile. A specification that defines the use of a standard, and defines all possible data streams that conform to that profile. An AP insures interoperability of different/multiple implementations of a standard. In this context, it completely and unambiguously represents the information requirements for a particular application of digital graphics data.

6.3.3 Basic values. The subset of permissible values for parameters of a CGM element that are mandatory for conformance to this specification.

6.3.4 Computer Graphics Metafile. The specification for a mechanism for storing and transferring illustration data. Refer to FIPS PUB 128.

6.3.5 Conforming basic generator. A metafile generator that produces only conforming basic metafiles (or can be reliably commanded to function in that mode), and additionally conforms to any additional generator requirements as explained in section 3.

6.3.6 Conforming basic interpreter. An metafile interpreter that at least correctly interprets any conforming basic metafile,

and conforms to any additional interpreter requirements as explained in section 3.

6.3.7 Draft level. The metafile interpreter level for all documents except those for final document production.

6.3.8 Metafile. Synonymous with CGM. A representation for the storage and transfer of graphical data and control information. This representation contains a device-independent description of one or more pictures.

6.3.9 Metafile generator. The software or hardware that creates a picture or conveys information in the CGM representation.

6.3.10 Metafile interpreter. The software or hardware that reads a CGM metafile and interprets the contents.

6.3.11 Permissible values. The range of values for a parameter of a CGM element as specified in FIPS PUB 128.

6.3.12 Publication level. The metafile interpreter level for final document production.

6.3.13 Vector Graphics. The presentation or storage of images as sequences of line segments.

Note: Refer to FIPS PUB 128, clause 3, for further definitions of computer graphics terms.

6.4 Subject term (keyword) listing.

Application profile  
CGM  
CGM metafile  
Digital  
FIPS PUB 128  
Technical illustrations  
Technical publications

# MIL-D-28003

Proposal Number: 2

Presentation date of proposal: 10 April 1987

Sponsoring Authority: ANSI

Class of Graphical Item: LINETYPE

Name: single arrow

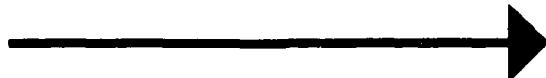
## Description

A single arrow linetype consists of a solid line terminated by an arrowhead as specified in ANSI Y14.2M-1979 (Line Conventions and Lettering) requirements for dimension and leader lines. The arrow is rendered so that the arrow tip occurs at the last point of the list of points passed to a polyline and is in the direction of the last vector.

This linetype is intended for use in engineering drawings.

Specific details are implementation dependent. The appearance of the degenerate case is implementation dependent.

Such a linetype has the following visual appearance:



## Additional Comments

The requirements stated in ANSI Y14.2M-1979 shall be followed when rendering this linetype.

This linetype is not intended to be used as an edgetype.

## Justification for Inclusion

This linetype is commonly used in engineering drawings. It is one of a set of linetypes to be registered for use with computer graphics standards to enable compact storage and transfer of engineering drawings.

## Relationship to Standards

- 1) ISO 7942 (GKS) - Specifies a registered linetype to supplement those defined in 5.4.1.
- 2) ISO 8632 (CGM) - Specifies a registered linetype to supplement those defined in 5.7.2.
- 3) ANSI Y14.2M-1979 - Line Conventions and Lettering.

FIGURE 1: Example of LINE TYPE single arrow

## MIL-D-28003

Proposal Number: 3	
Presentation date of proposal: 10 April 1987	
Sponsoring Authority: ANSI	
Class of Graphical Item: LINETYPE	
Name: single dot	
<b>Description</b> A single dot linetype consists of a solid line terminated by a dot as specified in ANSI Y14.2M-1979 (Line Conventions and Lettering) requirements for leader lines. The dot is rendered so that the dot occurs at the last point in the list of points passed to a polyline.  This linetype is intended for use in engineering drawings.  Specific details are implementation dependent. The appearance of the degenerate case is implementation dependent.  Such a linetype has the following visual appearance:	
	
<b>Additional Comments</b> The requirements stated in ANSI Y14.2M-1979 shall be followed when rendering this linetype.  This linetype is not intended to be used as an edgetype.	
<b>Justification for Inclusion</b> This linetype is commonly used in engineering drawings. It is one of a set of linetypes registered for use with computer graphics standards to enable compact storage and transfer of engineering drawings.	
<b>Relationship to Standards</b> 1) ISO 7942 (GKS) - Specifies a registered linetype to supplement those defined in 5.4.1. 2) ISO 8632 (CGM) - Specifies a registered linetype to supplement those defined in 5.7.2. 3) ANSI Y14.2M-1979 - Line Conventions and Lettering.	

FIGURE 2: Example of LINE TYPE single dot

## MIL-D-28003

<b>Proposal Number:</b> 4	
<b>Presentation date of proposal:</b> 10 April 1987	
<b>Sponsoring Authority:</b> ANSI	
<b>Class of Graphical Item:</b> LINETYPE	
<b>Name:</b> double arrow	
<b>Description</b> A double arrow linetype consists of a solid line terminated by two arrowheads as specified in ANSI Y14.2M-1979 (Line Conventions and Lettering) requirements for dimension lines. The arrows are rendered so that the arrow tip occurs at the first and last points in the list of points passed to a polyline. This linetype is intended for use in engineering drawings. Specific details are implementation dependent. The appearance of the degenerate case is implementation dependent. Such a linetype has the following visual appearance:	
	
<b>Additional Comments</b> The requirements stated in ANSI Y14.2M-1979 shall be followed when rendering this linetype. This linetype is not intended to be used as an edgetype.	
<b>Justification for Inclusion</b> This linetype is commonly used in engineering drawings. It is one of a set of linetypes registered for use with computer graphics standards to enable compact storage and transfer of engineering drawings.	
<b>Relationship to Standards</b> 1) ISO 7942 (GKS) - Specifies a registered linetype to supplement those defined in 5.4.1. 2) ISO 8632 (CGM) - Specifies a registered linetype to supplement those defined in 5.7.2. 3) ANSI Y14.2M-1979 - Line Conventions and Lettering.	

FIGURE 3: Example of LINE TYPE double arrow

MIL-D-28003

Proposal Number: 5	
Presentation date of proposal: 10 April 1987	
Sponsoring Authority: ANSI	
Class of Graphical Item: LINETYPE	
Name: stitch line	
<b>Description</b> A stitch line linetype consists of dashes and spaces of equal length as specified in ANSI Y14.2M-1979 (Line Conventions and Lettering.)	
This linetype is intended for use in engineering drawings. Its definition contains rendition requirements beyond those for the dashed linetype already present in the graphics standards.	
Specific details are implementation dependent. The appearance of the degenerate case is implementation dependent.	
Such a line has the following visual appearance:	
	
<b>Additional Comments</b> The requirements stated in ANSI Y14.2M-1979 shall be followed when rendering this linetype. In some cases, it is necessary for the standard (e.g. GKS) to exercise precise control over the manner in which two lines intersect in a drawing. In these cases it may be appropriate for the client to simulate this linetype by using sequences of correctly placed individual line segments.	
This linetype is not intended to be used as an edgetype.	
<b>Justification for Inclusion</b> This linetype is commonly used in engineering drawings. It is one of a set of linetypes registered for use with computer graphics standards to enable compact storage and transfer of engineering drawings.	
<b>Relationship to Standards</b> 1) ISO 7942 (GKS) - Specifies a registered linetype to supplement those defined in 5.4.1. 2) ISO 8632 (CGM) - Specifies a registered linetype to supplement those defined in 5.7.2. 3) ANSI Y14.2M-1979 - Line Conventions and Lettering.	

FIGURE 4: Example of LINE TYPE stitch line.

## MIL-D-28003

Proposal Number: 6	
Presentation date of proposal: 10 April 1987	
Sponsoring Authority: ANSI	
Class of Graphical Item: LINETYPE	
Name: chain line	
<b>Description</b> A chain line linetype consists of alternating long and short dashes as specified in ANSI Y14.2M-1979 (Line Conventions and Lettering.)	
This linetype is intended for use in engineering drawings. Its rendition is different from that of the dashed-dotted linestyle already present in the graphics standards.	
Specific details are implementation dependent. The appearance of the degenerate case is implementation dependent.	
Such a line has the following visual appearance:	
	
<b>Additional Comments</b> The requirements stated in ANSI Y14.2M-1979 shall be followed when rendering this linetype. In some cases, it is necessary for the standard (e.g. GKS) to exercise precise control over the manner in which two lines intersect in a drawing. In these cases it may be appropriate for the client to simulate this linetype by using sequences of correctly placed individual line segments.	
This linetype is not intended to be used as an edgetype.	
<b>Justification for Inclusion</b> This linetype is commonly used in engineering drawings. It is one of a set of linetypes registered for use with computer graphics standards to enable compact storage and transfer of engineering drawings.	
<b>Relationship to Standards</b> 1) ISO 7942 (GKS) - Specifies a registered linetype to supplement those defined in 5.4.1. 2) ISO 8632 (CGM) - Specifies a registered linetype to supplement those defined in 5.7.2. 3) ANSI Y14.2M-1979 - Line Conventions and Lettering.	

FIGURE 5: Example of LINE TYPE chain line

## MIL-D-28003

Proposal Number: 7	
Presentation date of proposal: 10 April 1987	
Sponsoring Authority: ANSI	
Class of Graphical Item: LINETYPE	
Name: center line	
<b>Description</b>	
A center line linetype consists of alternating long and short dashes as specified in ANSI Y14.2M-1979 (Line Conventions and Lettering.)	
This linetype is intended for use in engineering drawings. The long dashes may vary in length depending on the size of the drawing. Lines drawn in this linetype shall start and end with long dashes. A very short line may be unbroken.	
Specific details are implementation dependent. The appearance of the degenerate case is implementation dependent.	
Such a line has the following visual appearance:	
	
<b>Additional Comments</b>	
The requirements stated in ANSI Y14.2M-1979 shall be followed when rendering this linetype. In some cases, it is necessary for the standard (e.g. GKS) to exercise precise control over the manner in which two center lines intersect in a drawing. In these cases it may be appropriate for the client to simulate this linetype by using sequences of correctly placed individual line segments.	
This linetype is not intended to be used as an edgetype.	
<b>Justification for Inclusion</b>	
This linetype is commonly used in engineering drawings. It is one of a set of linetypes registered for use with computer graphics standards to enable compact storage and transfer of engineering drawings.	
<b>Relationship to Standards</b>	
1) ISO 7942 (GKS) - Specifies a registered linetype to supplement those defined in 5.4.1. 2) ISO 8632 (CGM) - Specifies a registered linetype to supplement those defined in 5.7.2. 3) ANSI Y14.2M-1979 - Line Conventions and Lettering.	

FIGURE 6: Example of LINE TYPE center line.

## MIL-D-28003

Proposal Number: 8

Presentation date of proposal: 10 April 1987

Sponsoring Authority: ANSI

Class of Graphical Item: LINETYPE

Name: hidden line

### Description

A hidden line linetype consists of short evenly spaced dashes as specified in ANSI Y14.2M-1979 (Line Conventions and Lettering.)

This linetype is intended for use in engineering drawings. The dashes may vary in length depending on the size of the drawing. Lines, not polylines, drawn in this linetype shall start and end with a dash. Dashes will join at corners, and arcs drawn with this style shall start and end with dashes. These rendition requirements are different from the dashed linetype already defined in the graphics standards.

Specific details are implementation dependent. The appearance of the degenerate case is implementation dependent.

Such a line has the following visual appearance:



### Additional Comments

The requirements stated in ANSI Y14.2M-1979 shall be followed when rendering this linetype. In some cases, it is necessary for the standard (e.g. GKS) to exercise precise control over the manner in which two lines intersect in a drawing. In these cases it may be appropriate for the client to simulate this linetype by using sequences of correctly placed individual line segments.

This linetype is not intended to be used as an edgetype.

### Justification for Inclusion

This linetype is commonly used in engineering drawings. It is one of a set of linetypes registered for use with computer graphics standards to enable compact storage and transfer of engineering drawings.

### Relationship to Standards

- 1) ISO 7942 (GKS) - Specifies a registered linetype to supplement those defined in 5.4.1.
- 2) ISO 8632 (CGM) - Specifies a registered linetype to supplement those defined in 5.7.2.
- 3) ANSI Y14.2M-1979 - Line Conventions and Lettering.

FIGURE 7: Example of LINE TYPE hidden line.

# MIL-D-28003

Proposal Number: 9

Presentation date of proposal: 10 April 1987

Sponsoring Authority: ANSI

Class of Graphical Item: LINETYPE

Name: phantom line

## Description

A phantom line linetype consists of long dashes separated by pairs of short dashes as specified in ANSI Y14.2M-1979 (Line Conventions and Lettering.)

This linetype is intended for use in engineering drawings. Lines, not polylines, drawn in this linetype shall start and end with long dashes which may vary in length depending on the size of the drawing.

Specific details are implementation dependent. The appearance of the degenerate case is implementation dependent.

Such a line has the following visual appearance:



## Additional Comments

The requirements stated in ANSI Y14.2M-1979 shall be followed when rendering this linetype. In some cases, it is necessary for the standard (e.g. GKS) to exercise precise control over the manner in which two lines intersect in a drawing. In these cases it may be appropriate for the client to simulate this linetype by using sequences of correctly placed individual line segments.

This linetype is not intended to be used as an edgetype.

## Justification for Inclusion

This linetype is commonly used in engineering drawings. It is one of a set of linetypes registered for use with computer graphics standards to enable compact storage and transfer of engineering drawings.

## Relationship to Standards

- 1) ISO 7942 (GKS) - Specifies a registered linetype to supplement those defined in 5.4.1.
- 2) ISO 8632 (CGM) - Specifies a registered linetype to supplement those defined in 5.7.2.
- 3) ANSI Y14.2M-1979 - Line Conventions and Lettering.

FIGURE 8: Example of LINE TYPE phantom line

## MIL-D-28003

Proposal Number: 10

Presentation date of proposal: 10 April 1987

Sponsoring Authority: ANSI

Class of Graphical Item: LINETYPE

Name: break line - style 1

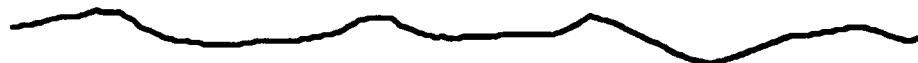
### Description

A break line linetype - style 1 - consists of either one of two allowable representations as specified in ANSI Y14.2M-1979 (Line Conventions and Lettering.) This is simply a line having a "freehand" appearance.

This linetype is intended for use in engineering drawings.

Specific details are implementation dependent. The appearance of the degenerate case is implementation dependent.

Such a line has the following visual appearance:



### Additional Comments

The requirements stated in ANSI Y14.2M-1979 shall be followed when rendering this linetype.

This linetype is not intended to be used as an edgetype.

### Justification for Inclusion

This linetype is commonly used in engineering drawings. It is one of a set of linetypes registered for use with computer graphics standards to enable compact storage and transfer of engineering drawings.

### Relationship to Standards

- 1) ISO 7942 (GKS) - Specifies a registered linetype to supplement those defined in 5.4.1.
- 2) ISO 8632 (CGM) - Specifies a registered linetype to supplement those defined in 5.7.2.
- 3) ANSI Y14.2M-1979 - Line Conventions and Lettering.

FIGURE 9: Example of LINE TYPE break line, style 1.

**MIL-D-28003**

**Proposal Number:** 11

**Presentation date of proposal:** 10 April 1987

**Sponsoring Authority:** ANSI

**Class of Graphical Item:** LINETYPE

**Name:** break line - style 2

**Description**

A break line linestyle consists of either one of two allowable representations as specified in ANSI Y14.2M-1979 (Line conventions and Lettering.) This is a line consisting of long dashes joined by zigzags.

This linetype is intended for use in engineering drawings.

Specific details are implementation dependent. The appearance of the degenerate case is implementation dependent.

Such a line has the following visual appearance:



**Additional Comments**

The requirements stated in ANSI Y14.2M-1979 shall be followed when rendering this linetype.

This linetype is not intended to be used as an edgetype.

**Justification for Inclusion**

This linetype is commonly used in engineering drawings. It is one of a set of linetypes registered for use with computer graphics standards to enable compact storage and transfer of engineering drawings.

**Relationship to Standards**

- 1) ISO 7942 (GKS) - Specifies a registered linetype to supplement those defined in 5.4.1.
- 2) ISO 8632 (CGM) - Specifies a registered linetype to supplement those defined in 5.7.2.
- 3) ANSI Y14.2M-1979 - Line Conventions and Lettering.

**FIGURE 10: Example of LINE TYPE break line, style 2**

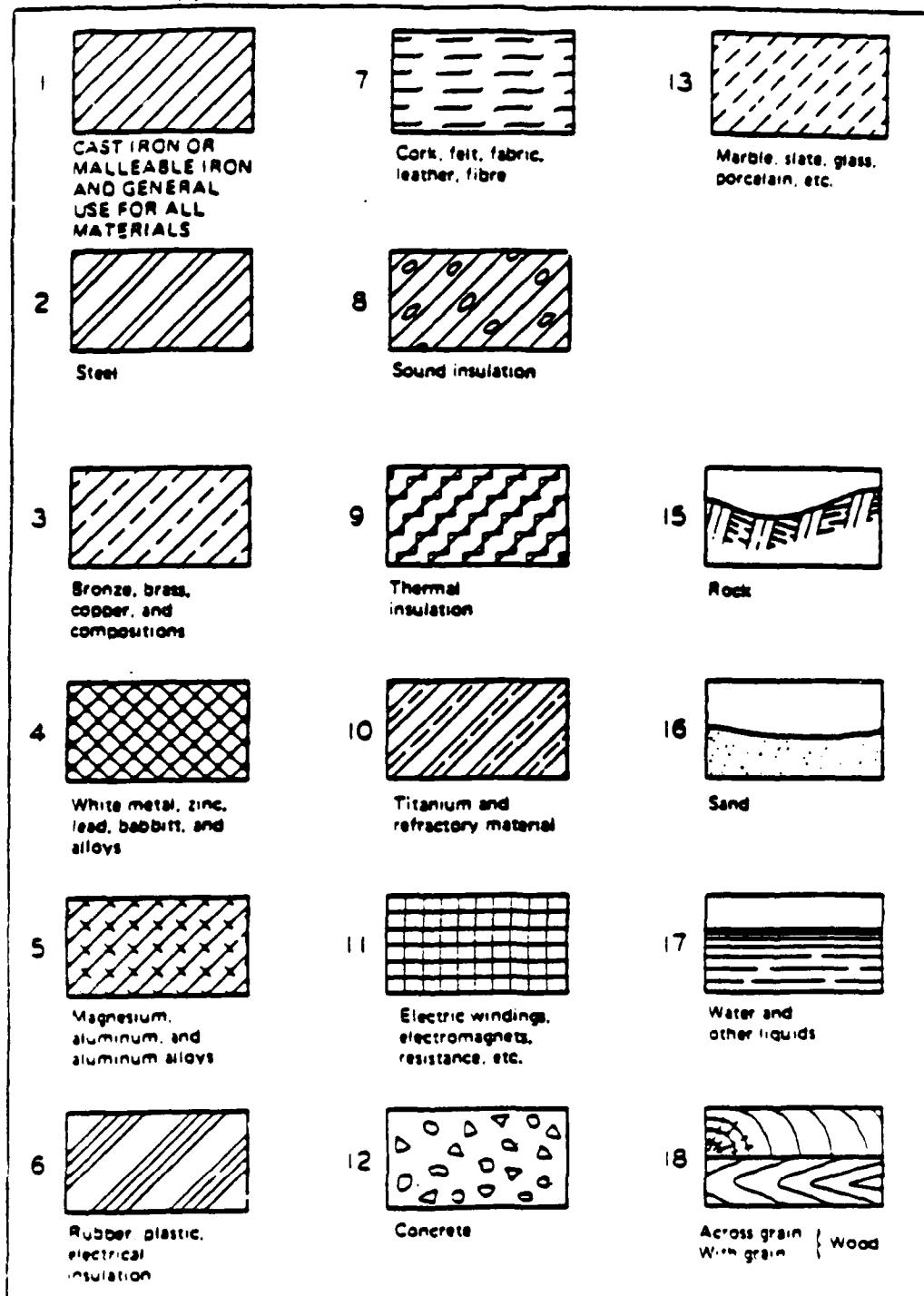


FIGURE 11: Examples of hatch styles

**Custodians:**

Army - CR  
Navy - SH  
Air Force - 24  
DLA - DH

**Preparing Activity**

OSD-CL  
(Project ILSS - 0034)

**Review activities:**

Army - AM  
Air Force - 01,02  
NSA - NS  
DCA - DC  
NASA - NA  
Others - NBS, DOE, GPO, NCS

**User activities:**

OSD - IR  
Army - AL, AT, AV, EA, ER, GL, ME, MI, MR, SM, TE, TM  
Navy - AS, EC, OS, SA, YD  
Air Force - 11, 13, 14, 17, 18, 19, 68, 79, 99

## STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER MIL-D-28003	2. DOCUMENT TITLE <u>Digital Representation For Communication of Illustration Data; CGM Application Profile</u>
3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION (Mark one)
3b. ADDRESS (Street, City, State, ZIP Code)	<input type="checkbox"/> VENDOR <input type="checkbox"/> USER <input type="checkbox"/> MANUFACTURER <input type="checkbox"/> OTHER (Specify): _____
5. PROBLEM AREAS	
a. Paragraph Number and Wording:	
b. Recommended Wording:	
c. Reason/Rationale for Recommendation:	
6. REMARKS	
7a. NAME OF SUBMITTER (Last, First, MI) - Optional	8. WORK TELEPHONE NUMBER (Include Area Code) - Optional
c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional	
8. DATE OF SUBMISSION (YYMMDD)	

**INSTRUCTIONS:** In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (DO NOT STAPLE), and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problem. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

**NOTE:** This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

(Fold along this line)

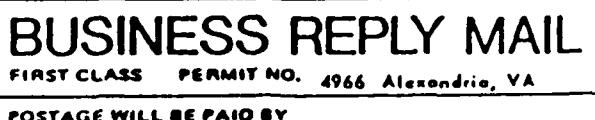
(Fold along this line)

Director, CALS Policy Office  
OASD (P&L) WSIG  
The Pentagon, Rm. 2B322  
Washington, DC 20301-8000



NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES

OFFICIAL BUSINESS  
PENALTY FOR PRIVATE USE \$300



Defense Systems Improvement  
and Analysis Office  
c/o Defense Logistics Agency  
Cameron Station  
Alexandria, VA 22304-6183

